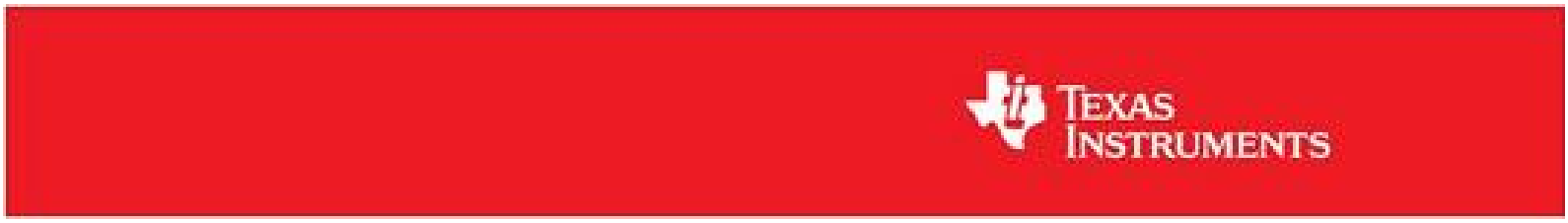
LM195QML

LM195QML Ultra Reliable Power Transistors



Literature Number: SNLS194

National Semiconductor

November 30, 2010

LM195QML

Ultra Reliable Power Transistors

General Description

The LM195 is a fast, monolithic power integrated circuit with complete overload protection. This device, which acts as a high gain power transistor, has included on the chip, current limiting, power limiting, and thermal overload protection making it virtually impossible to destroy from any type of overload.

The inclusion of thermal limiting, a feature not easily available in discrete designs, provides virtually absolute protection against overload. Excessive power dissipation or inadequate heat sinking causes the thermal limiting circuitry to turn off the device preventing excessive heating.

The LM195 offers a significant increase in reliability as well as simplifying power circuitry. In some applications, where protection is unusually difficult, such as switching regulators, lamp or solenoid drivers where normal power dissipation is low, the LM195 is especially advantageous.

The LM195 is easy to use and only a few precautions need be observed. Excessive collector to emitter voltage can destroy the LM195 as with any power transistor. When the device is used as an emitter follower with low source impedance, it is necessary to insert a 5.0k resistor in series with the base lead to prevent possible emitter follower oscillations. Although the device is usually stable as an emitter follower, the resistor eliminates the possibility of trouble without degrading performance. Finally, since it has good high frequency response, supply bypassing is recommended.

Features

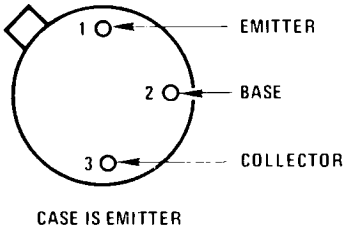
- Internal thermal limiting
- Greater than 1.0A output current
- 3.0 µA typical base current
- 500 ns switching time
- 2.0V saturation
- Base can be driven up to 40V without damage
- Directly interfaces with CMOS or TTL
- 100% electrical burn-in

Ordering Information

NS Part Number	SMD Part Number	NS Package Number	Package Description
LM195H/883	5962–8777801XA	H03B	3LD T0–5 Metal Can

Connection Diagram

TO-5 Metal Can Package



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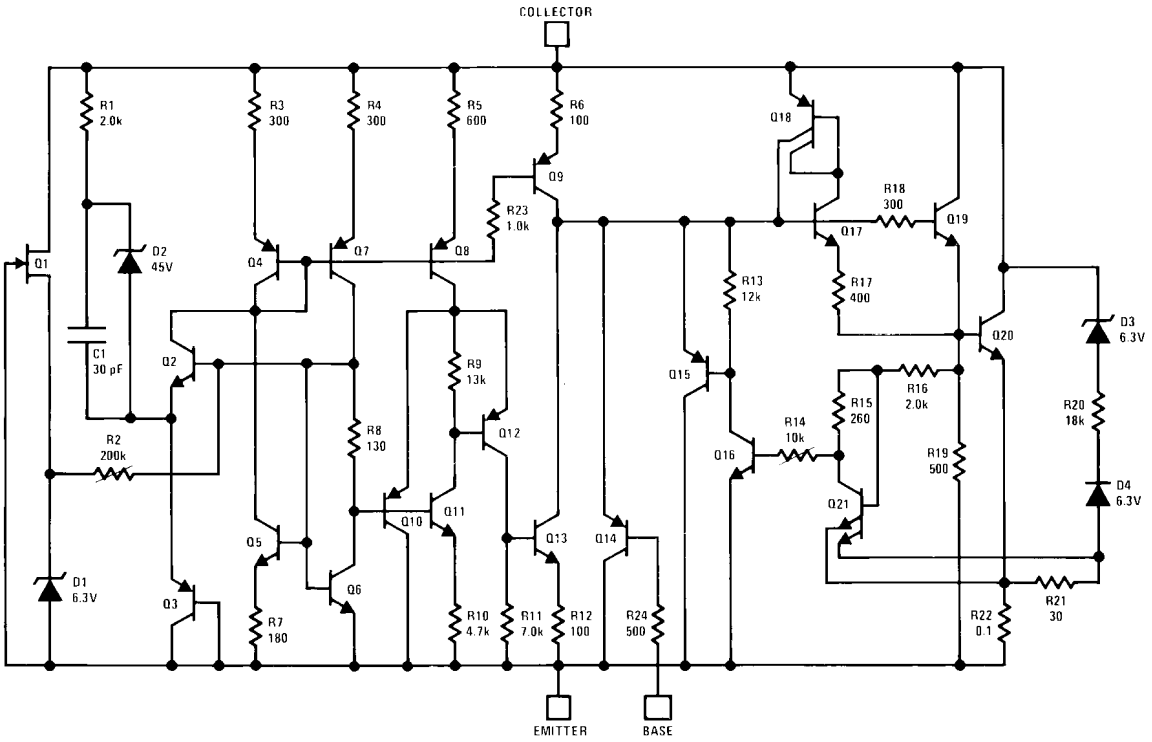
Bottom View
See NS Package Number H03B

Schematic Diagram



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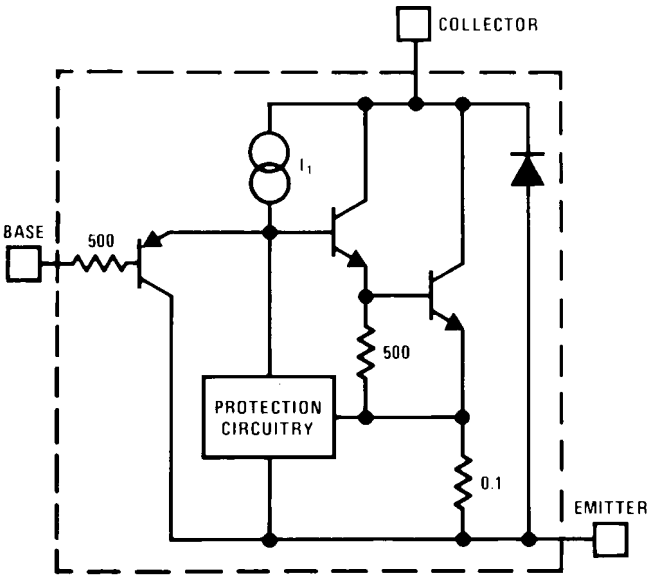
Simplified Circuit



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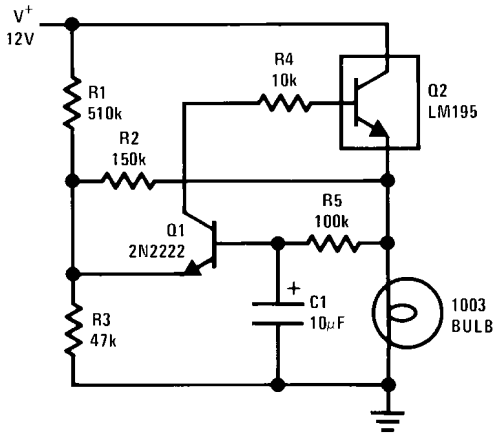
1.0 Amp Lamp Flasher



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Absolute Maximum Ratings (*Note 1*)

Collector to Emitter Voltage	42V
Collector to Base Voltage	42V
Base to Emitter Voltage (Forward)	42V
Base to Emitter Voltage (Reverse)	20V
Collector Current	Internally Limited
Power Dissipation (*Note 2*)	Internally Limited
Operating Temperature Range	
H-Pkg	$-55°C \leq T_A \leq +125°C$
Storage Temperature Range	$-65°C \leq T_A \leq +150°C$
Lead Temperature (Soldering, 10 sec.)	260°C
Thermal Resistance	
θ_{JA}	
H-Pkg; Still Air @ 0.5W	192°C/W
H-Pkg; 500LF/Min Air Flow @ 0.5W	66°C/W
θ_{JC}	
H-Pkg @ 1.0W	29°C/W

Quality Conformance Inspection

Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	-55

LM195H/883 Electrical Characteristics

DC Parameter Collector to Emitter

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_{CE}	Operating Voltage	$I_C \leq I_{Max}$	(*Note 3*)		42	V	1, 2, 3

DC Parameter Base to Emitter

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
BV_{BE}	Breakdown Voltage	$V_{CE} \leq 42V$	(*Note 3*)	42		V	1, 2, 3
I_{SC}	Collector Current	$V_{CE} \leq 7V$		1.2		A	1
				1		A	2, 3
V_{Sat}	Saturation Voltage	$I_C = 1A$			2	V	1, 2
					2.5	V	3
I_B	Base Current	$0 \leq V_{BE} \leq 42V$, $I_C \leq I_{Max}$			5	µA	1, 2, 3
I_Q	Quiescent Current	$V_{CE} = 42V$, $V_{BE} = 0V$			5	mA	1, 2, 3
V_{Bk}	Breakdown Delta V_{BE}	V_C = 46-42V, I_L = 50mA		-0.03	0.01	V	1
		V_C = 46-38V		-0.03	0.01	V	1
		V_C = 50-42V		-0.03	0.01	V	1
Thr	Thermal Response	100µS		-10	100	mV	1
		500µS		-10	70	mV	1
		2mS		-10	50	mV	1
		20mS		-10	10	mV	1

AC Parameter

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
t_{ON}	Response Time	V_I = 0-2V, R_L = 36Ω, V+ = 36V			1.8	µS	9, 10, 11
t_{OFF}	Response Time	V_I = 2-0V, R_L = 36Ω, V+ = 36V			1.8	µS	9, 10, 11

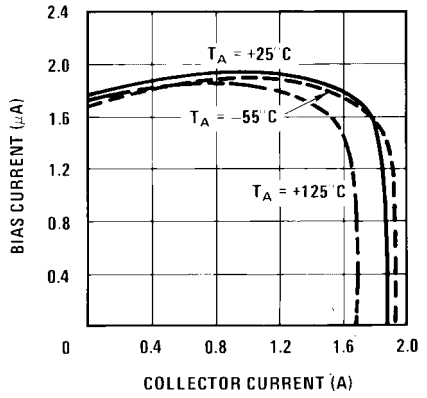
Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

Note 3: Parameter tested go–no–go only.

Typical Performance Characteristics

Bias Current



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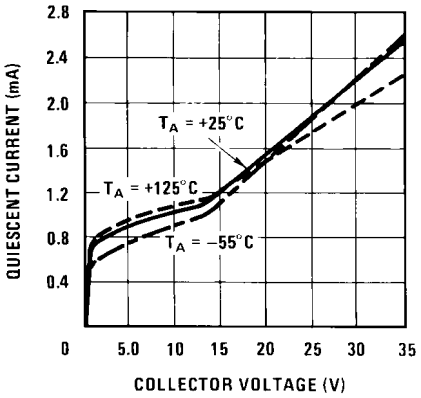
Quiescent Current



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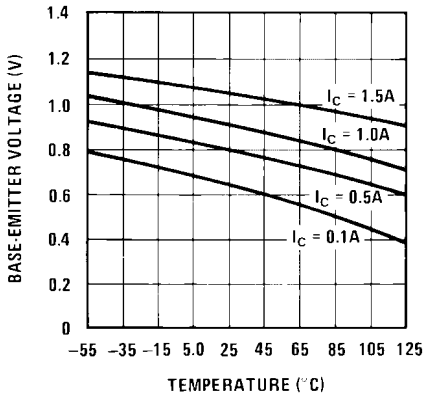
Base Emitter Voltage



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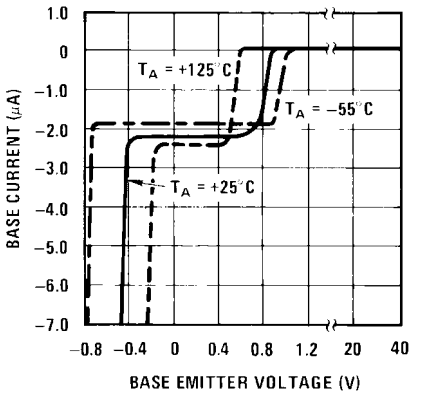
Base Current



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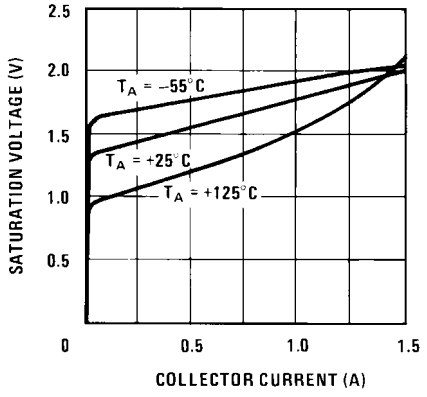
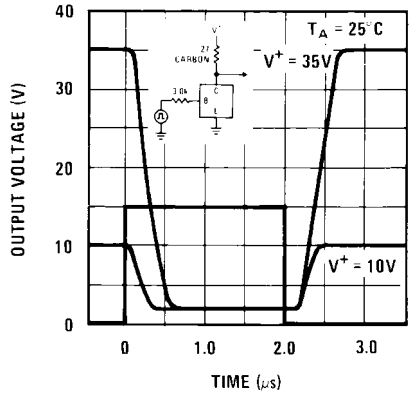
Saturation Voltage



20156539

Response Time



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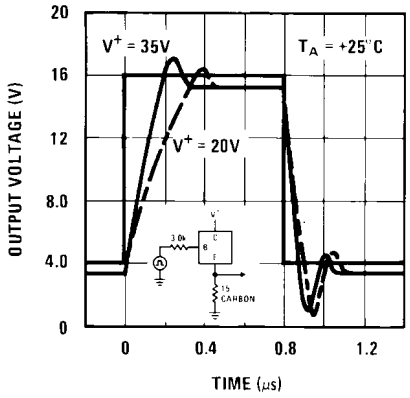
Response Time



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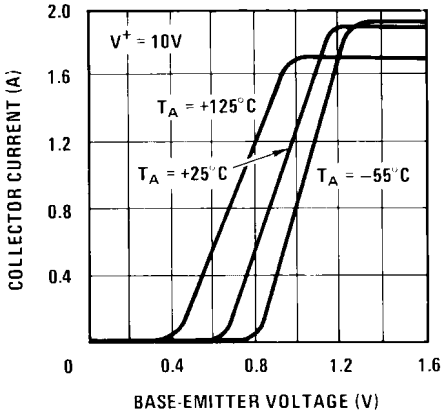
10V Transfer Function



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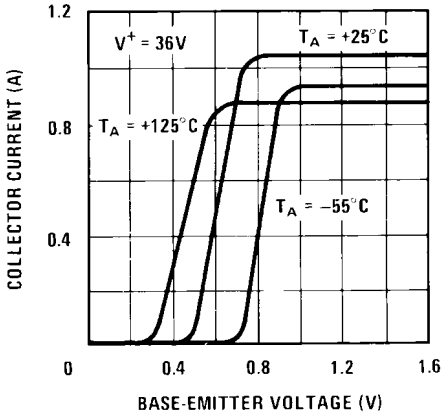
36V Transfer Function



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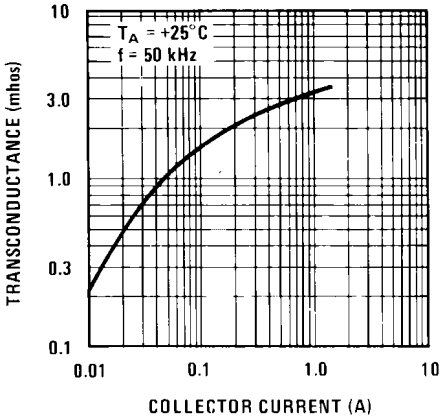
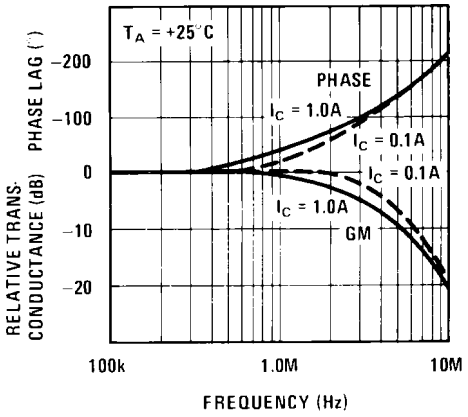
Transconductance



20156509

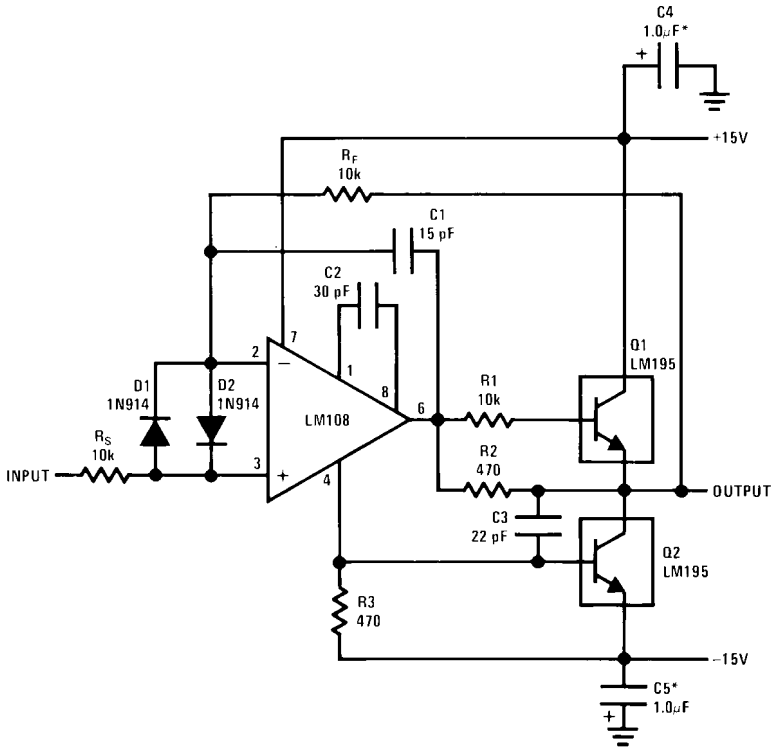
Small Signal Frequency Response



20156510

Typical Applications

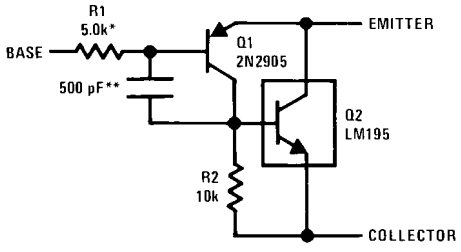
1.0 Amp Voltage Follower



20156512

*Solid Tantalum

Power PNP

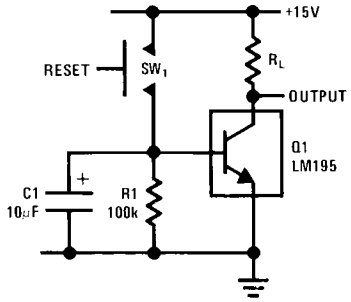


20156513

*Protects against excessive base drive

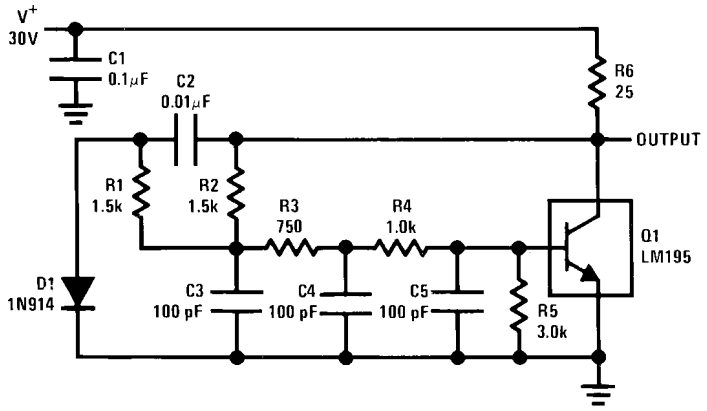
**Needed for stability

Time Delay



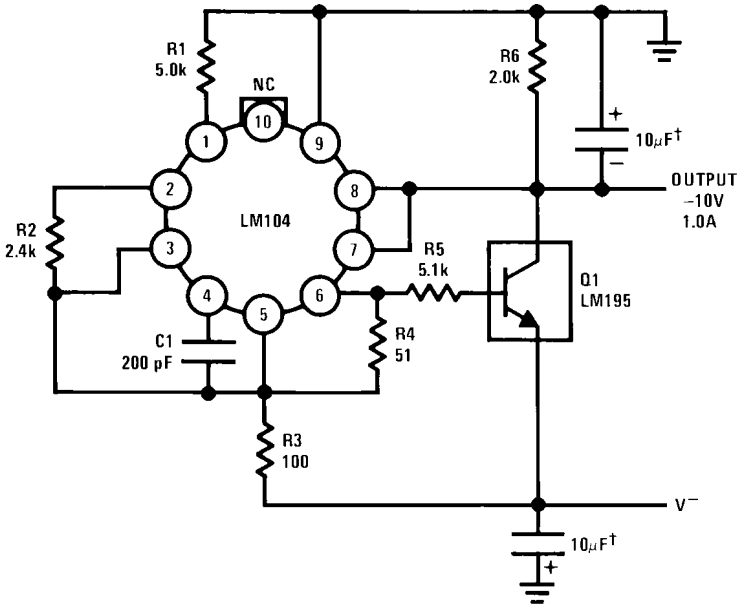
20156514

1.0 MHz Oscillator



20156515

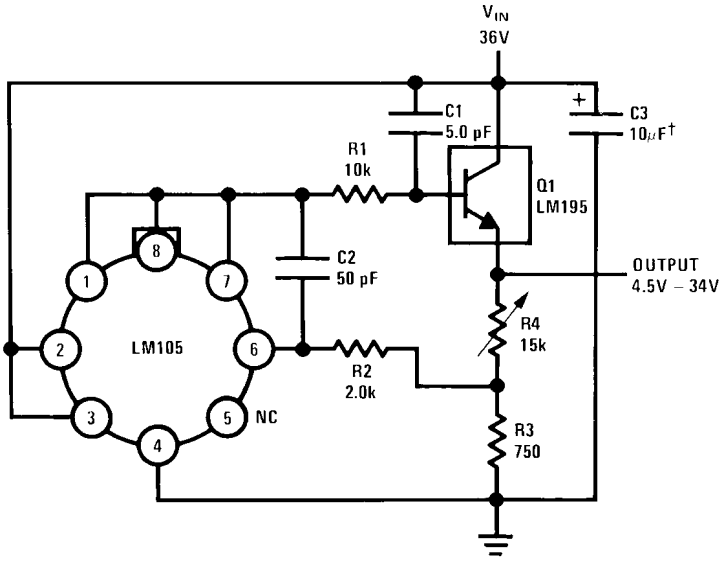
1.0 Amp Negative Regulator



20156517

†Solid Tantalum

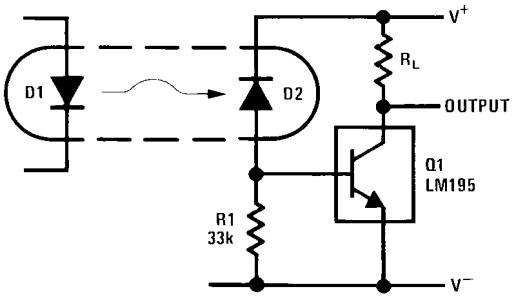
1.0 Amp Positive Voltage Regulator



20156518

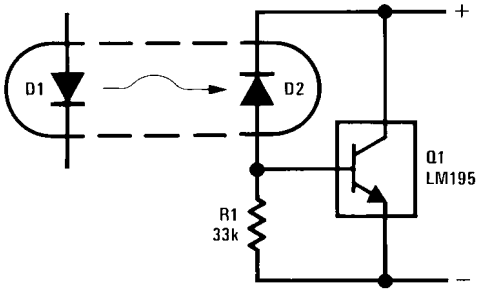
†Solid Tantalum

Fast Optically Isolated Switch



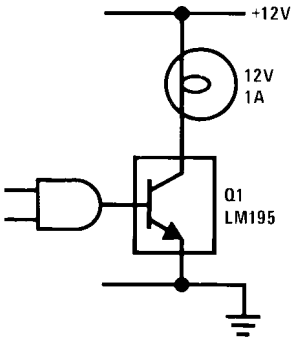
20156519

Optically Isolated Power Transistor



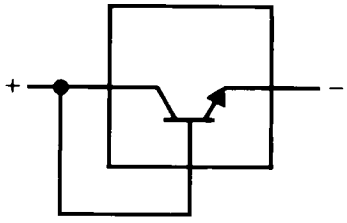
20156520

CMOS or TTL Lamp Interface



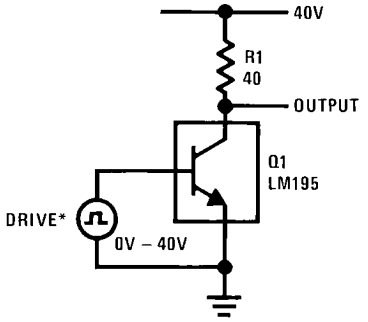
20156521

Two Terminal Current Limiter



20156522

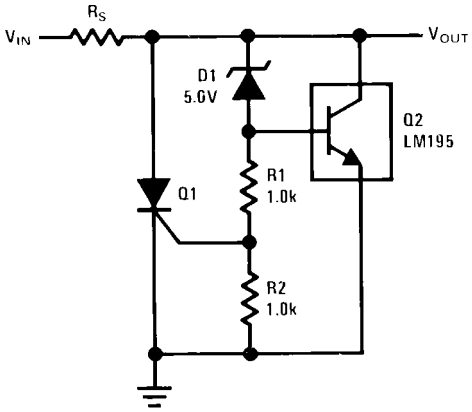
40V Switch



20156523

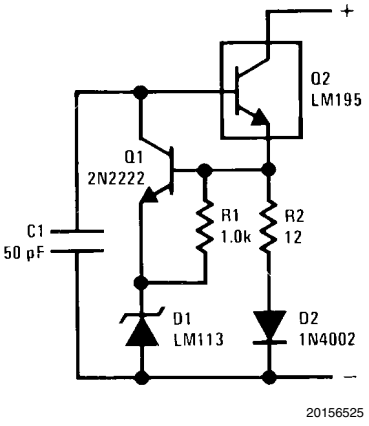
*Drive Voltage 0V to ≥ 10V ≤ 42V

6.0V Shunt Regulator with Crowbar



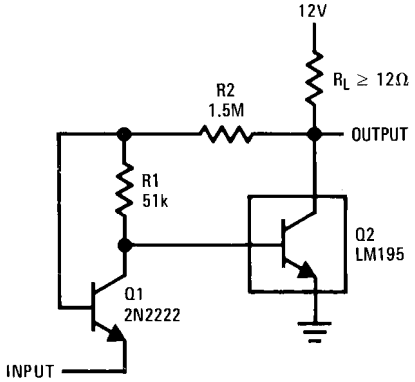
20156524

Two Terminal 100 mA Current Regulator



20156525

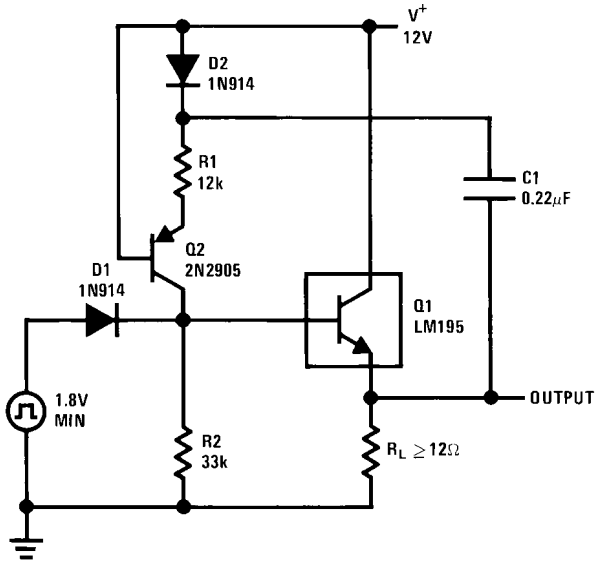
Low Level Power Switch



20156526

Turn ON = 350 mV
Turn OFF = 200 mV

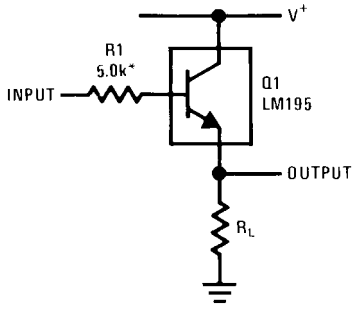
Power One-Shot



20156527

T = R1C
R2 = 3R1
R2 ≤ 82k

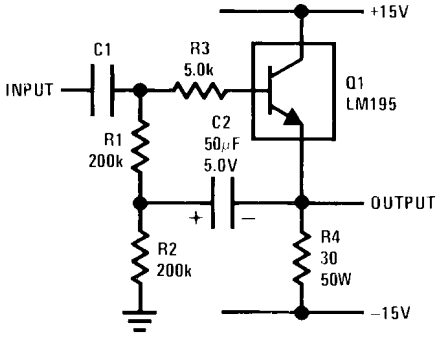
Emitter Follower



20156528

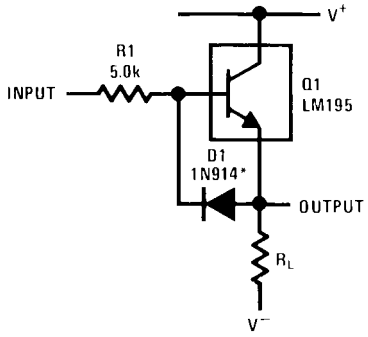
*Need for Stability

High Input Impedance AC Emitter Follower



20156529

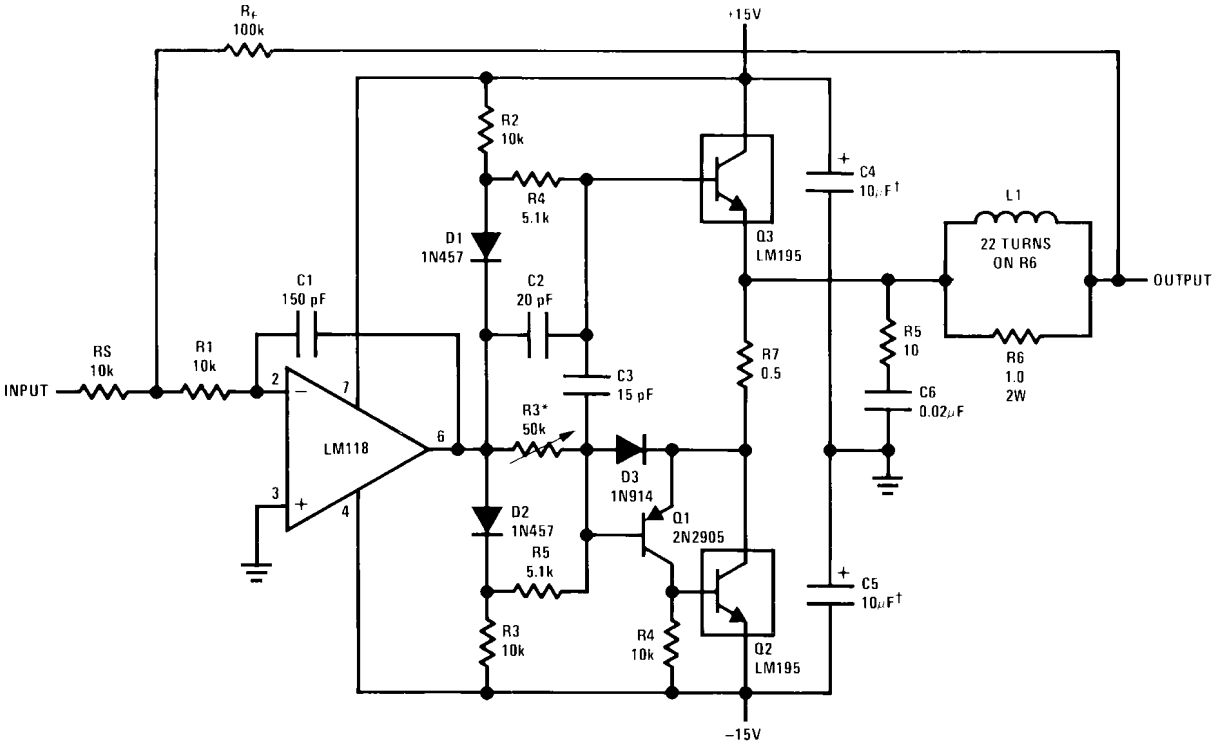
Fast Follower



20156530

*Prevents storage with fast fall time square wave drive

Power Op Amp

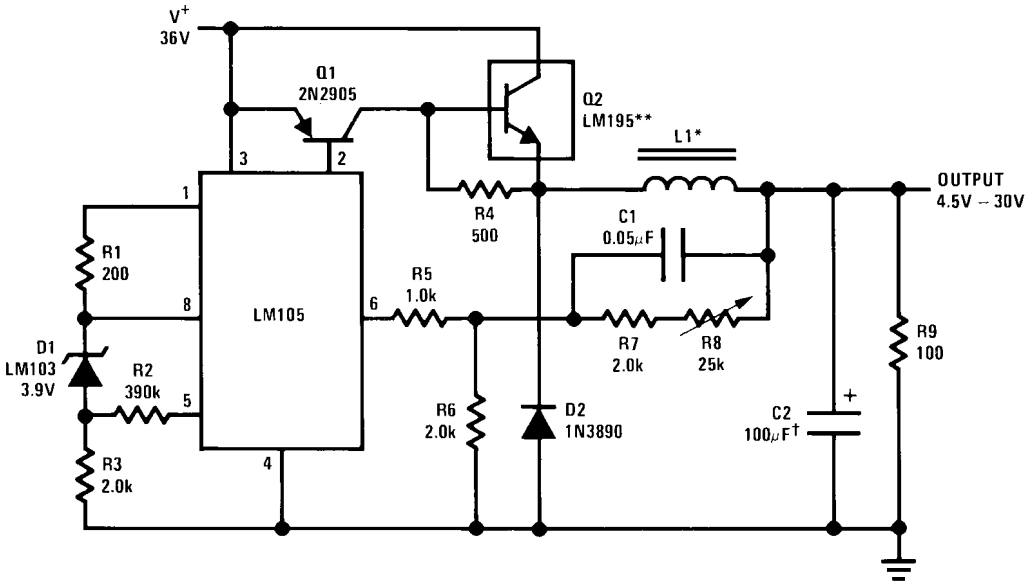


20156531

*Adjust for 50 mA quiescent current

†Solid Tantalum

6.0 Amp Variable Output Switching Regulator



*Sixty turns wound on Arnold Type A-083081-2 core.

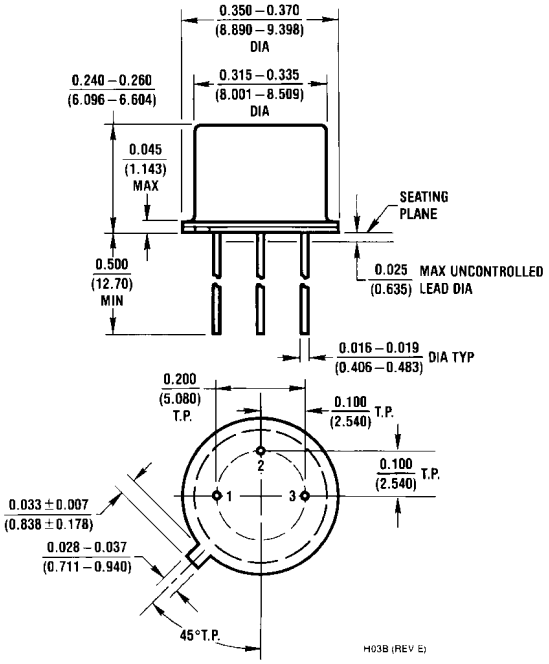
**Four devices in parallel

†Solid tantalum

Revision History Section

Released	Revision	Section	Changes
11/30/2010	A	New Release, Corporate format	1 MDS data sheets converted into one Corp. data sheet format. MNLM195-H Rev 0BL will be archived.

Physical Dimensions inches (millimeters) unless otherwise noted



TO-5 Metal Can Package
NS Package Number H03B

Notes

Notes

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LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
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